

**WHAT IS CLAIMED IS:**

1. A voltage-impressed current measuring apparatus which impresses a prescribed voltage and measures the current flowing to a load apparatus, comprising

5       a current-range switching portion having: a plurality of pairs connecting in series a plurality of current buffers with switches, having output stages capable of being electrically connected or disconnected in response to a supplied control signal, and current measurement resistances of differing resistance values respectively connected to the output stages of the current  
10 buffers with switches, wherein any one of the pairs is selected by a control signal to switch the current measurement range, said output stage of the current buffer with switch of said selected pair taken to be in a connected state;

      a direct-current power supply portion, supplying a prescribed direct-  
15 current voltage to said load apparatus through the series connection of the current buffer with switch and current measurement resistance selected by said current range switching means; and

      a potential difference measuring means, measuring, as a value corresponding to the current flowing in said load apparatus, the potential  
20 difference across the two ends of the current measurement resistance of said series connection due to the current which accompanies the impression of said direct-current voltage on said load apparatus and flows from the current buffer with switch of said selected series connection to said load apparatus.

2. A voltage-impressed current measuring apparatus according to Claim  
25 1, wherein said direct-current power supply portion comprises a digital-to-analog converter which converts the supplied digital voltage value to an analog reference voltage, and an operational amplifier which controls by feedback the voltage impressed on said load apparatus with respect to said

reference voltage and supplies [the impressed voltage] to said load apparatus via said range switching portion.

3. A voltage-impressed current measuring apparatus according to Claim 2, wherein: the input sides of said plurality of current buffers with switches  
5 of said range switching portion are mutually connected and are connected to the output side of said operational amplifier; the output sides of said current measurement resistances are mutually connected; and the input side voltage of the current buffers with switches and the output side voltage of said current measurement resistances are supplied to said potential difference measuring  
10 portion as the voltages at both ends of the current measurement resistance of said selected series connection.

4. A voltage-impressed current measuring apparatus according to Claim 2, wherein: the input sides of said plurality of current buffers with switches of said range switching portion are mutually connected and are connected to  
15 the output side of said operational amplifier; the output sides of said current measurement resistances are mutually connected; said range switching portion additionally selects, in response to said control signal, one output of said plurality of current buffers with switches; there is provided a multiple-contact switch supplying [said one output] to said potential difference measuring  
20 portion as the voltage at one end of said current measurement resistance of said selected series connection; and said voltage at the output side of said current measurement resistance is supplied to said potential difference measuring portion as the voltage on the side of the other end of the current measurement resistance of said selected series connection.

25 5. A voltage-impressed current measuring apparatus according to Claim 2, wherein: the input sides of said plurality of current buffers with switches of said range switching portion are mutually connected and are connected to the output side of said operational amplifier; the output sides of said current

measurement resistances are mutually connected; said range switching portion additionally has buffers with switches, having output stages which can be connected / blocked in response to control signals and being respectively connected to the output sides of said plurality of current buffers with  
5 switches; the output of one buffer with switch, selected by said control signal, is supplied to the potential difference measuring portion as the voltage on the side of one end of said current measurement resistance of said selected series connection; and said voltage on the output sides of said current measurement resistances is supplied to said potential difference measuring portion as the  
10 voltage on the side of the other end of the current measurement resistance of said selected series connection.

6. A voltage-impressed current measuring apparatus according to Claim 2, wherein: the output sides of said current measurement resistances of said plurality of series connections are mutually connected; said range switching  
15 portion additionally comprises, with respect to each said current buffer with switch, feedback operational amplifiers having inverted inputs to which are connected the outputs of the same current buffers with switches, non-inverted inputs to which is supplied the voltage from said current power supply portion, and outputs to which are connected the inputs of said current buffers  
20 with switches; the voltage supplied to the non-inverted input of each said feedback operational amplifier is supplied to said potential difference measuring portion as the voltage on the side of one end of said current measurement resistance of said selected series connection; and the voltage on the output side of said current measurement resistance is supplied to said  
25 potential difference measuring portion as the voltage on the side of the other end of the current measurement resistance of said selected series connection.

7. A voltage-impressed current measuring apparatus according to Claim 2, wherein said current power supply portion comprises a first resistance

inserted between the output of said digital-to-analog converter and the inverted input of said operational amplifier, and a second resistance inserted in the feedback path from said load apparatus to the inverted input of said operational amplifier, and the non-inverted input of said operational amplifier  
5 is connected to ground.

8. A voltage-impressed current measuring apparatus according to any of Claims 1 to 7, each said current buffer with switch having a pre-stage portion and said output stage,

wherein said output stages have complementary first and second  
10 transistors which have their emitters mutually connected, the voltage of the same connection point taken to be the output voltage of said current buffers with switches, and their collectors connected respectively to a positive power supply and a negative power supply; and

wherein said pre-stage portions [each] comprise  
15 a first PNP transistor and a first NPN transistor, in which: the emitters are respectively connected to a first and a second constant-current supply; the collectors are respectively connected to a negative power supply and a positive power supply, the voltage from said direct-current power supply portion being supplied to the respective bases as the input voltage; and a first  
20 base voltage, the base emitter voltage added to said input voltage, and a second base voltage, the base emitter voltage subtracted from said input voltage, are supplied from the respective emitters to the bases of said complementary first and second transistors;

a second PNP transistor having a collector and an emitter connected  
25 respectively to the base of said complementary second transistor and said positive power supply; a second NPN transistor having a collector and an emitter connected respectively to the base of said complementary first transistor and said negative power supply; and

a control means, which, when said current buffer with switch is non-selected in response to said control signal, supplies to said first and second constant-current supplies a first and a second OPEN signal changing said first and second constant-current supplies to OFF, supplies a third and a fourth  
5 OPEN signal to the bases of said second PNP transistor and said second NPN transistor putting the same transistors into the ON state, thereby holding said complementary first and second transistors of said output stage in the OFF state, and which, when said current buffer with switch is selected, supplies to said first and second constant-current supplies a first and a second OPEN  
10 signal changing said first and second constant-current supplies to ON, and supplies a third and a fourth OPEN signal to the bases of said second PNP transistor and said second NPN transistor putting the same transistors into the OFF state, thereby putting said complementary first and second transistors of said output stage into the ON state.

15 9. A current buffer with switch, having a pre-stage portion and an output stage,

wherein said output stage has complementary first and second transistors which have their emitters mutually connected, the voltage of the same connection point taken to be the output voltage of said current buffers  
20 with switches, and their collectors connected respectively to a positive power supply and a negative power supply; and

wherein said pre-stage portion comprises

a first PNP transistor and a first NPN transistor, in which: the emitters are respectively connected to a first and a second constant-current supply; the  
25 collectors are respectively connected to a negative power supply and a positive power supply, the voltage from said direct-current power supply portion being supplied to the respective bases as the input voltage; and a first base voltage, the base emitter voltage added to said input voltage, and a

second base voltage, the base emitter voltage subtracted from said input voltage, are supplied from the respective emitters to the bases of said complementary first and second transistors;

5 a second PNP transistor having a collector and an emitter connected respectively to the base of said complementary second transistor and said positive power supply; a second NPN transistor having a collector and an emitter connected respectively to the base of said complementary first transistor and said negative power supply; and

10 a control means which, when said current buffer with switch is non-selected in response to said control signal, supplies to said first and second constant-current supplies a first and a second OPEN signal changing said first and second constant-current supplies to OFF, supplies a third and a fourth OPEN signal to the bases of said second PNP transistor and said second NPN transistor putting the same transistors into the ON state, thereby holding said  
15 complementary first and second transistors of said output stage in the OFF state; and which, when said current buffer with switch is selected, supplies to said first and second constant-current supplies a first and a second OPEN signal changing said first and second constant-current supplies to ON, and supplies a third and a fourth OPEN signal to the bases of said second PNP  
20 transistor and said second NPN transistor putting the same transistors into the OFF state, thereby putting said complementary first and second transistors of said output stage into the ON state.